Remarks/Arguments

Applicants respectfully request further examination and reconsideration in view of the above amendments and arguments set forth fully below. Claims 1, 8-27, 29-33, 35-127 were previously pending in the present application. Claims 9, 11, 15-18, 20-27, 33, 35-37, 39, 42, 43, 45-127 were previously withdrawn. By the above amendments, Claims 1 and 19 are amended. Accordingly, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 are currently pending in this application.

Drawing Requirement

In the Applicants' response of November 9, 2007, the Applicants submitted a duplicate of Figure 21 because the Applicants indicated that the response of November 9, 2007 includes the response of July 27, 2007. The Applicants did not intend the duplicate of Figure 21 to be a the replacement sheet. In the Office Action, the Examiner is unsure which drawing is the replacement drawing and requests a properly labeled replacement sheet. Accordingly, since the Applicants did not intend the duplicate of Figure 21 to be the replacement sheet, a properly labeled replacement sheet is not included in this response.

Rejections under 35 U.S.C. §112

Within the Office Action, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner states that in Claim 1, it is unclear whether Applicant are claiming the combination of a heat exchanger and heat source or just the heat exchanger alone.

By the above amendment, Claim 1 has been amended to recite "heat exchanging layer is integrally disposed with the heat source and includes a porous microstructure disposed thereon". Accordingly, it is clear from this limitation that the Applicants are claiming the combination of a heat exchanger and heat source. Support for this limitation is found on page 13, line 26 through page 14, line 2 of the specification. Claims 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 are dependent on the independent Claim 1 including the amended claim limitation "heat exchanging layer is integrally disposed with the heat source and includes a porous microstructure disposed thereon". For at least these reasons, Applicants respectfully request that the rejection of Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 under 35 U.S.C. §112, second paragraph, be

withdrawn.

Rejections under 35 U.S.C. §102 and §103

Within the Office Action, Claims 1, 10, 12, 13, 14, 17, 19, 32, 38 and 40 are rejected under 35 U.S.C. §102(b) as being anticipated by, or, in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 5,761,037 to Anderson et al. (hereafter "Anderson"). The Applicants respectfully traverse this rejection for at least the following reasons.

Anderson teaches an evaporator for cooling components. [Anderson, Abstract] The evaporator includes a housing for containment of the working fluid. The housing possesses a surface 104 which is placed in thermal contact with the object body, chip or module to be cooled. The evaporator housing may comprise heated surface 104 and cap 105. A wicking layer 103 is immediately adjacent to the surface 104. [Anderson, column 3, lines 45-59] The evaporator includes wick member 102 and optional wicking spreader 101. [Anderson, column 3, line 65 through column 4, line 3] The cap 105 is provided with an inlet port 106 and an exhaust port 107 situated along the perimeter of the cap 105. [Anderson, column 4, lines 18-20] The surface 104 is in thermal contact with the chip 30, which is disposed on a printed circuit board 31. [Anderson, column 4, lines 48-52] However, Anderson does not teach that the *interface layer is integrally disposed with the heat source.*

In contrast to Anderson, the present invention is directed to a heat exchanger. The heat exchanger comprises an interface layer that performs thermal exchange with the heat source and is configured to pass fluid from a first side to a second side. [Present Specification, Abstract] The heat exchanger is integrally formed into the heat source, whereby the heat exchanger and the heat source are formed as one piece. [Present Specification, page 13, lines 26-28] Thus, the interface layer is integrally disposed with the heat source and is formed as one piece with the heat source. [Present Specification, page 14, lines 1-2] As described above, Anderson does not teach that the *interface layer is integrally disposed with the heat source.*

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion in contact with a heat source configured along a plane, wherein the conducting portion conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to the heat exchanging layer, the *heat exchanging layer is integrally disposed with the heat source* and includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough, further wherein the fluid is distributed such that at least one

interface hot spot region in the heat source is selectively cooled. As described above, Anderson does not teach that the *interface layer is integrally disposed with the heat source.* For at least these reasons, the independent Claim 1 is allowable over Anderson.

Claims 10, 12, 13, 14, 17, 19, 32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Anderson. Accordingly, Claims 10, 12, 13, 14, 17, 19, 32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 10, 12, 13, 14, 17, 19, 32, 38 and 40 are rejected under 35 U.S.C. §103(a) as obvious over the combined teachings of Anderson and U.S. Patent No. 5,983,997 to Hou (hereafter "Hou") or U.S. Patent No. 5,239,200 to Messina et al. (hereafter "Messina"). The Applicants respectfully traverse this rejection for at least the following reasons. As described above, Anderson does not teach that the *interface layer integrally disposed with the heat source.*

Hou teaches a system for cooling electronic components including a cold plate. The cold plate has a channel through which a fluid coolant is transported, a plurality of bosses each receiving a heat generating component, and a plurality of fin structures. [Hou, Abstract] In contrast to the present invention, Hou does not teach that the *interface layer is integrally disposed with the heat source.* Instead, each of the bosses contacts a heat generating component. The heat generating components are secured to each boss by drilling and tapping the boss and providing a screw. Accordingly, neither Anderson, Hou nor their combination teach that the interface layer is integrally disposed with the heat source.

Messina teaches an apparatus for cooling an array of integrated circuit chips mounted on a substrate. [Messina, Abstract] Disposed in a cooling relationship over the array of chips is a heat transfer module. A cold plate is disposed in a cooling relationship over heat transfer module. [Messina, column 3, lines 14-20; FIG. 1] To provide a sealed enclosure for the coolant, an overhead cover member is disposed over cooling plate. [Messina, column 3, lines 42-45] An inlet and outlet are provided through cover surface on opposite ends of the cover to permit entry and exit of the coolant fluid. [Messina, column 4, lines 3-6] In contrast to the present invention, Messina does not teach that the *interface layer is integrally disposed with the heat source.* Accordingly, neither Anderson, Messina nor their combination teach that the interface layer is integrally disposed with the heat source.

In contrast to the teachings of Anderson, Hou, the combination of Anderson and Hou, Messina and the combination of Anderson and Messina, the present invention is directed to a

heat exchanger. The heat exchanger comprises an interface layer that performs thermal exchange with the heat source and is configured to pass fluid from a first side to a second side. The heat exchanger is integrally formed into the heat source, whereby the heat exchanger and the heat source are formed as one piece. Thus, the interface layer is integrally disposed with the heat source and is formed as one piece with the heat source. As discussed above, neither Anderson, Hou nor the combination of Anderson and Hou, Messina nor the combination of Anderson and Messina teach that the interface layer is integrally disposed with the heat source. When taken separately or as a combination, Anderson, Messina and Hou do not teach or suggest the teachings of the present invention.

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion in contact with a heat source configured along a plane, wherein the conducting portion conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to the heat exchanging layer, the *heat exchanging layer is integrally disposed with the heat source* and includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough, further wherein the fluid is distributed such that at least one interface hot spot region in the heat source is selectively cooled. As discussed above, neither Anderson, Hou nor the combination of Anderson and Hou, Messina nor the combination of Anderson and Messina teach that the interface layer is integrally disposed with the heat source. For at least these reasons, the independent Claim 1 is allowable over the teachings of Anderson, Hou, the combination of Anderson and Hou, Messina and the combination of Anderson and Messina.

Claims 10, 12, 13, 14, 17, 19, 32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Anderson, Hou, the combination of Anderson and Hou, Messina and the combination of Anderson and Messina. Accordingly, Claims 10, 12, 13, 14, 17, 19, 32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claim 8 is rejected under 35 U.S.C. §103(a) as unpatentable over Anderson alone or in view of Hou or Messina as applied to Claim 1, and further in view of U.S. Patent No. 3,993,123 to Chu (hereafter "Chu"). The Applicants respectfully traverse this rejection for at least the following reasons. Claim 8 is dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Anderson, Hou, the combination

of Anderson and Hou, Messina and the combination of Anderson and Messina. Accordingly, Claim 8 is also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claim 16 is rejected under 35 U.S.C. §103(a) as unpatentable over Anderson alone or in view of Hou or Messina as applied to Claim 1, and further in view of U.S. Patent No. 4,758,926 to Herrell (hereafter "Herrell"). The Applicants respectfully traverse this rejection for at least the following reasons. Claim 16 is dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Anderson, Hou, the combination of Anderson and Hou, Messina and the combination of Anderson and Messina. Accordingly, Claim 16 is also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 29-32 is rejected under 35 U.S.C. §103(a) as unpatentable over Anderson alone or in view of Hou or Messina as applied to Claim 1, and further in view of U.S. Patent No. 6,680,044 to Tonkovich (hereafter "Tonkovich"). The Applicants respectfully traverse this rejection for at least the following reasons. Claims 29-32 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Anderson, Hou, the combination of Anderson and Hou, Messina and the combination of Anderson and Messina. Accordingly, Claims 29-32 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are rejected under 35 U.S.C. §103(a) as obvious over the combined teachings of Herrell in view of the Jiang et al. article "Thermal-Hydraulic performance of small scale micro-channel and porous-media heat exchangers" (hereafter "Jiang"). The Applicants respectfully traverse this rejection for at least the following reasons.

Herrell teaches a package for enclosing, protecting and cooling semiconductor integrated circuit chips. [Herrell, Abstract] The package includes a heat sink assembly coupled to a substrate assembly. [Herrell, column 4, lines 58-68] The heat sink assembly is aligned with the substrate assembly carrying the integrated circuit chips, and then the cover is aligned to the heat sink assembly. The whole package is temporarily clamped for single heat cycle that solders the bolt heads. [Herrell, column 8, lines 16-24] In contrast to the present invention, Herrell does not teach that the *interface layer is integrally disposed with the heat source*. Instead, the substrate assembly and the heat sink assembly are separately pre-assembled to keep the integrated circuit chips exposed until final assembly and sealing.

In Jiang, the flow and heat transfer performances of a micro-channel heat-exchanger and a micro-porous heat-exchanger are theoretically and experimentally investigated and evaluated. The experimental apparatus consisted of water tanks, pumps, a test section, regulator valves, accurate manometers, instrumentation to measure temperatures, an electric heater system and filters. The test section contained either a micro-channel heat-exchanger or a micro-porous heat-exchanger. [Herrell, page 1041] The heat-exchangers are fabricated from stacked cooper plates. To manufacture the micro-channel heat-exchanger, the stack is heated until soldering tin is melted. To manufacture the micro-porous heat-exchanger, the stack is sintered together with small copper particles. The heat-exchangers are packaged and sealed. [Herrell, page 1041-1042] In contrast to the present invention, Jiang does not teach that the *interface layer is integrally disposed with the heat source.* Accordingly, neither Herrell, Jiang nor their combination teach that the interface layer is integrally disposed with the heat source.

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion in contact with a heat source configured along a plane, wherein the conducting portion conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to the heat exchanging layer, the *heat exchanging layer is integrally disposed with the heat source* and includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough, further wherein the fluid is distributed such that at least one interface hot spot region in the heat source is selectively cooled. As discussed above, neither Herrell, Jiang nor their combination teach that the interface layer is integrally disposed with the heat source. For at least these reasons, the independent Claim 1 is allowable over the teachings of Herrell, Jiang and their combination.

Claims 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Herrell, Jiang and their combination. Accordingly, Claims 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1, 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are rejected under 35 U.S.C. §103(a) as being unpatentable over Herrell in view of U.S. Patent No. 4,896,719 to O'Neill (hereafter "O'Neill") and Tonkovich. The Applicants respectfully traverse this rejection for at least the following reasons. As described above, Herrell does not teach that the *interface layer is integrally disposed with the heat source.*

O'Neill teaches a plenum in combination with a heat exchange panel and a panel structure having a large number of closely spaced orifices of equal size. [O'Neill, Abstract] A conduit provides fluid to the panel structure. [O'Neill, column 2, lines 8-10] The fluid is forced into the heat exchanging panel through orifices and out of the heat exchanging panel through orifices. [O'Neill, column 3, lines 13-18] In contrast to the present invention, O'Neill does not teach that the *interface layer is integrally disposed with the heat source.*

Tonkovich teaches chemical reactors and reaction chambers and methods for conducting chemical reactions having gas phase reactants. [Tonkovich, Abstract] Tonkovich does not disclose a heat exchanging system. As such, Tonkovich does not teach that the *interface layer is integrally disposed with the heat source.* Accordingly, neither Herrell, O'Neill, Jiang nor their combination teach that the interface layer is integrally disposed with the heat source.

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion in contact with a heat source configured along a plane, wherein the conducting portion conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to the heat exchanging layer, the *heat exchanging layer is integrally disposed with the heat source* and includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough, further wherein the fluid is distributed such that at least one interface hot spot region in the heat source is selectively cooled. As discussed above, neither Herrell, O'Neill, Jiang nor their combination teach that the interface layer is integrally disposed with the heat source. For at least these reasons, the independent Claim 1 is allowable over the teachings of Herrell, O'Neill, Jiang and their combination.

Claims 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over Herrell, O'Neill, Jiang and their combination. Accordingly, Claims 8, 10, 12, 13, 14, 16, 17, 19, 29, 30-32, 38 and 40 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 1 and 32 are rejected under 35 U.S.C. §102(b) as being anticipated by, or, in the alternative, under 35 U.S.C. §103(a) as obvious over O'Neill. The Applicants respectfully traverse this rejection for at least the following reasons. As described above, O'Neill does not teach that the *interface layer is integrally disposed with the heat source.*

The independent Claim 1 teaches a heat exchanger. The heat exchanger of Claim 1 comprises a body having a conducting portion in contact with a heat source configured along a

plane, wherein the conducting portion conducts heat from the heat source to a heat exchanging layer configured within the body, the body including at least one inlet port and at least one outlet port, wherein the at least one inlet port channels fluid to the heat exchanging layer, the *heat exchanging layer is integrally disposed with the heat source* and includes a porous microstructure disposed thereon and is configured to distribute the fluid and to pass the distributed fluid therethrough, further wherein the fluid is distributed such that at least one interface hot spot region in the heat source is selectively cooled. As described above, O'Neill does not teach that the *interface layer is integrally disposed with the heat source*. For at least these reasons, the independent Claim 1 is allowable over O'Neill.

Claim 26 is dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over O'Neill. Accordingly, Claim 26 is also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 29-32 are rejected under 35 U.S.C. §103(a) as being unpatentable over O'Neill as applied to Claims 1 and 32, and further in view of Tonkovich. The Applicants respectfully traverse this rejection for at least the following reasons. Claims 29-32 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable over O'Neill. Accordingly, Claims 29-32 are all also allowable as being dependent upon an allowable base claim.

Within the Office Action, Claims 41 and 44 are rejected under 35 U.S.C. §103(a) as being unpatentable over any of the prior art reference as applied to Claim 1, and further in view of US Patent No. 5,918,469 or International Publication WO 01/25711 A1 to Cardella (hereafter "Cardella"). The Applicants respectfully traverse this rejection for at least the following reasons. Claims 44 and 41 are dependent on the independent Claim 1. As discussed above, the independent Claim 1 is allowable. Accordingly, Claims 41 and 44 are all also allowable as being dependent upon an allowable base claim.

The Applicants respectfully request examination and reconsideration in view of the amendments above and remarks above. Following the above amendments, Claims 1, 8, 10, 12-14, 16, 17, 19, 29-32, 38, 40, 41 and 44 are currently pending. Should the Examiner have any questions or comments, he or she is encouraged to call the undersigned at (408) 530-9700 to discuss the same so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
HAVERSTOCK & OWENS LLP

Dated: 4-3-08

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CERTIFICATE OF MAILING (37 CFR§ 1.8(a))
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